

Radio Test Report

Report No.: STS2405015W02

Issued for

THINKCAR TECH CO., LTD.

2606, building 4, phase II, TiananYungu, Gangtou community,
Bantian, Longgang District, Shenzhen, China

Product Name: THINKCAR VENU 5 Pro

Brand Name: THINKCAR, XHINKCAR, MUCAR

Model Name: VENU 5 Pro

Series Model(s): N/A

FCC ID: 2AUARVENU5PRO

Test Standards: FCC Part 15.231

The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Shenzhen STS Test Services Co., Ltd.

**TEST REPORT**

Applicant's Name.....: THINKCAR TECH CO., LTD.

Address: 2606, building 4, phase II, TiananYungu, Gangtou community,
Bantian, Longgang District, Shenzhen, China

Manufacturer's Name.....: THINKCAR TECH CO., LTD.

Address: 2606, building 4, phase II, TiananYungu, Gangtou community,
Bantian, Longgang District, Shenzhen, China**Product Description**

Product Name.....: THINKCAR VENU 5 Pro

Brand Name: THINKCAR, XHINKCAR, MUCAR

Model Name: VENU 5 Pro

Series Model(s): N/A

Test Standards.....: FCC Part 15.231

Test Procedure: ANSI C63.10-2020

This device described above has been tested by STS, the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Shenzhen STS Test Services Co., Ltd.

Date of Test: 08 May 2024

Date of performance of tests.....: 08 May 2024 ~ 11 May 2024

Date of Issue: 11 May 2024

Test Result.....: **Pass**

Testing Engineer :

Aaron Bu

(Aaron Bu)

Technical Manager :

Chris Chen

(Chris Chen)

Authorized Signatory :

Bovey Yang

(Bovey Yang)



| TABLE OF CONTENTS | Page |
|--|-------------|
| 1. SUMMARY OF TEST RESULTS | 6 |
| 1.1 TEST FACTORY | 6 |
| 1.2 MEASUREMENT UNCERTAINTY | 6 |
| 2. GENERAL INFORMATION | 7 |
| 2.1 GENERAL DESCRIPTION OF THE EUT | 7 |
| 2.2 DESCRIPTION OF THE TEST MODES | 8 |
| 2.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED | 8 |
| 2.4 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS | 9 |
| 2.5 EQUIPMENTS LIST | 10 |
| 3. EMC EMISSION TEST | 11 |
| 3.1 CONDUCTED EMISSION MEASUREMENT | 11 |
| 3.2 TEST PROCEDURE | 12 |
| 3.3 TEST SETUP | 12 |
| 3.4 TEST RESULTS | 12 |
| 4. RADIATED EMISSION MEASUREMENT | 13 |
| 4.1 RADIATED EMISSION LIMITS | 13 |
| 4.2 TEST PROCEDURE | 15 |
| 4.3 DEVIATION FROM TEST STANDARD | 15 |
| 4.4 TEST SETUP | 16 |
| 4.5 EUT OPERATING CONDITIONS | 17 |
| 4.6 TEST RESULTS | 17 |
| 4.7 FIELD STRENGTH CALCULATION | 18 |
| 5. BANDWIDTH TEST | 24 |
| 5.1 LIMIT | 24 |
| 5.2 TEST REQUIREMENTS | 24 |
| 5.3 TEST PROCEDURE | 24 |
| 5.4 TEST SETUP | 24 |
| 5.5 EUT OPERATION CONDITIONS | 24 |
| 5.6 TEST RESULTS | 25 |
| 6. DUTY CYCLE | 27 |
| 6.1 TEST PROCEDURE | 27 |
| 6.2 TEST SETUP | 27 |
| 6.3 EUT OPERATION CONDITIONS | 27 |
| 6.4 TEST RESULTS | 28 |



| TABLE OF CONTENTS | Page |
|--|-------------|
| 7. AUTOMATICALLY DEACTIVATE | 32 |
| 7.1 STANDARD REQUIREMENT | 32 |
| 7.2 TEST PROCEDURE | 32 |
| 8. ANTENNA REQUIREMENT | 35 |
| 8.1 STANDARD REQUIREMENT | 35 |
| 8.2 EUT ANTENNA | 35 |
| APPENDIX 1-PHOTOS OF TEST SETUP | 36 |



Revision History

| Rev. | Issue Date | Report No. | Effect Page | Contents |
|------|-------------|---------------|-------------|---------------|
| 00 | 11 May 2024 | STS2405015W02 | ALL | Initial Issue |
| | | | | |



1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

| FCC Part 15.231, Subpart C | | | |
|---------------------------------|----------------------------|----------|--------|
| Standard Section | Test Item | Judgment | Remark |
| 15.207 | Conducted Emission | N/A | -- |
| 15.205(a)/15.209/ 15.231.(b) | Radiated Spurious Emission | PASS | -- |
| 15.231(a)(1)/ 15.231(b)(2) | Transmission requirement | PASS | -- |
| 15.231(C) | 20 dB Bandwidth | PASS | -- |
| 15.203 | Antenna Requirement | PASS | -- |

NOTE: (1) "N/A" denotes test is not applicable in this Test Report.

(2) All tests are according to ANSI C63.10-2020.

1.1 TEST FACTORY

SHENZHEN STS TEST SERVICES CO., LTD

Add. :101, Building B, Zhuoke Science Park, No.190 Chongqing Road, ZhanChengShequ, Fuhai Sub-District, Bao'an District, Shenzhen, Guang Dong, China

FCC test Firm Registration Number: 625569

IC test Firm Registration Number: 12108A

A2LA Certificate No.: 4338.01

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately **95** %.

| No. | Item | Uncertainty |
|-----|-----------------------------------|----------------------|
| 1 | RF output power, conducted | $\pm 0.755\text{dB}$ |
| 2 | Unwanted Emissions, conducted | $\pm 2.874\text{dB}$ |
| 3 | All emissions, radiated 9K-30MHz | $\pm 3.80\text{dB}$ |
| 4 | All emissions, radiated 30M-1GHz | $\pm 4.18\text{dB}$ |
| 5 | All emissions, radiated 1G-6GHz | $\pm 4.90\text{dB}$ |
| 6 | All emissions, radiated >6G | $\pm 5.24\text{dB}$ |
| 7 | Conducted Emission (9KHz-150KHz) | $\pm 2.19\text{dB}$ |
| 8 | Conducted Emission (150KHz-30MHz) | $\pm 2.53\text{dB}$ |
| 9 | Occupied Channel Bandwidth | $\pm 3.5\%$ |
| 10 | Power Spectral Density, conducted | $\pm 1.245\text{dB}$ |
| 11 | Duty Cycle | $\pm 3.2\%$ |

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

| | |
|-------------------------|--|
| Product Name | THINKCAR VENU 5 Pro |
| Trade Name | THINKCAR, XHINKCAR, MUCAR |
| Model Name | VENU 5 Pro |
| Series Model(s) | N/A |
| Model Difference | N/A |
| Frequency band | 433.92 MHz, 315MHz |
| Modulation Type | ASK |
| Battery | Rated Voltage: DC 3V Capacity: 345mAh |
| Hardware version number | V1.0 |
| Software version number | V1.0 |
| Connecting I/O Port(s) | N/A |

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User Manual.

2. Table for filed Antenna

| Ant. | Brand | Model Name | Antenna Type | Connector | Gain (dBi) | NOTE |
|------|---------------------------------|------------|--------------|-----------|------------|---------|
| 1 | THINKCAR, XHINKCAR, MUCAR | VENU 5 Pro | Internal | N/A | 0 | Antenna |

Note: The antenna information refers to the manufacturer's provided report, applicable only to the tested sample identified in the report.

2.2 DESCRIPTION OF THE TEST MODES

To investigate the maximum EMI emission characteristics generated from EUT, the test system was pre-scanning tested based on the consideration of following EUT operation mode or test configuration mode which possibly have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

| Pretest Mode | Description |
|--------------|-------------|
| Mode 1 | TX Mode |

| | For Radiated Emission |
|-----------------|-----------------------|
| Final Test Mode | Description |
| Mode 1 | TX Mode |

2.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

During test, Keep EUT is in continuous transmission mode, Both open button and closed button have been tested, The two keys were tested to assess and only record the worst case in the report (Open button).

| |
|------------|
| E-1 EUT |
|------------|

2.4 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Necessary accessories

| Item | Equipment | Mfr/Brand | Model/Type No. | Serial No. | Note |
|------|-----------|-----------|----------------|------------|------|
| N/A | N/A | N/A | N/A | N/A | N/A |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Support units

| Item | Shielded Type | Ferrite Core | Length | Note |
|------|---------------|--------------|--------|------|
| N/A | N/A | N/A | N/A | N/A |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Note:

(1) For detachable type I/O cable should be specified the length in cm in 『Length』 column.

2.5 EQUIPMENTS LIST

Radiation Test equipment

| Kind of Equipment | Manufacturer | Type No. | Serial No. | Last calibration | Calibrated until |
|---------------------------|------------------|----------------------------|--------------|------------------|------------------|
| Temperature & Humidity | SW-108 | SuWei | N/A | 2024.03.15 | 2025.03.14 |
| Pre-Amplifier(0.1M-3G Hz) | EM | EM330 | 060665 | 2024.02.23 | 2025.02.22 |
| Pre-Amplifier (1G-18GHz) | SKET | LNPA-01018G-45 | SK2018080901 | 2023.09.26 | 2024.09.25 |
| Positioning Controller | MF | MF-7802 | MF-780208587 | N/A | N/A |
| Signal Analyzer | R&S | FSV 40-N | 101823 | 2023.09.26 | 2024.09.25 |
| Filter Box | BALUN Technology | SU319E | BL-SZ1530051 | N/A | N/A |
| Bilog Antenna | TESEQ | CBL6111D | 34678 | 2022.09.30 | 2024.09.29 |
| Horn Antenna | SCHWARZBECK | BBHA 9120D | 02014 | 2023.09.24 | 2025.09.23 |
| Active loop Antenna | ZHINAN | ZN30900C | 16035 | 2023.02.28 | 2025.02.27 |
| Antenna Mast | MF | MFA-440H | N/A | N/A | N/A |
| Turn Table | EM | SC100_1 | 60531 | N/A | N/A |
| AC Power Source | APC | KDF-11010G | F214050035 | N/A | N/A |
| Test SW | FARAD | EZ-EMC(Ver.STSLAB-03A1 RE) | | | |

Conduction Test equipment

| Kind of Equipment | Manufacturer | Type No. | Serial No. | Last calibration | Calibrated until |
|------------------------|--------------|----------------------------|------------|------------------|------------------|
| Signal Analyzer | Agilent | N9020A | MY51510623 | 2024.02.23 | 2025.02.22 |
| Temperature & Humidity | SW-108 | SuWei | N/A | 2024.03.15 | 2025.03.14 |
| Test SW | FARAD | EZ-EMC(Ver.STSLAB-03A1 RE) | | | |

3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table.

| FREQUENCY (MHz) | Class B (dBuV) | | Standard |
|-----------------|----------------|-----------|----------|
| | Quasi-peak | Average | |
| 0.15 -0.5 | 66 - 56 * | 56 - 46 * | CISPR |
| 0.50 -5.0 | 56.00 | 46.00 | CISPR |
| 5.0 -30.0 | 60.00 | 50.00 | CISPR |

| | | | |
|-----------|-----------|-----------|-----|
| 0.15 -0.5 | 66 - 56 * | 56 - 46 * | FCC |
| 0.50 -5.0 | 56.00 | 46.00 | FCC |
| 5.0 -30.0 | 60.00 | 50.00 | FCC |

Note:

(1) The tighter limit applies at the band edges.

(2) The limit of “ * ” marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

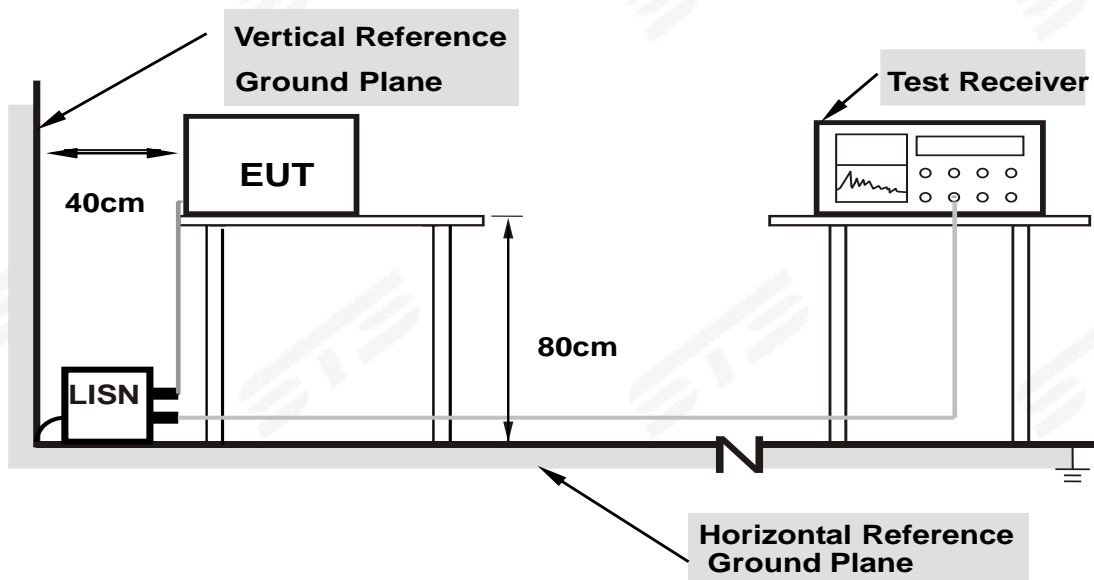
The following table is the setting of the receiver

| Receiver Parameters | Setting |
|---------------------|----------|
| Attenuation | 10 dB |
| Start Frequency | 0.15 MHz |
| Stop Frequency | 30 MHz |
| IF Bandwidth | 9 kHz |

3.2 TEST PROCEDURE

- The EUT is 0.8 m from the horizontal ground plane and 0.4 m from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments are powered from additional LISN(s). The LISN provides 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- LISN at least 80 cm from nearest part of EUT chassis.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.3 TEST SETUP



Note: 1. Support units were connected to second LISN.

2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes support units.

3.4 TEST RESULTS

| | | | |
|---------------|-------|--------------------|-----|
| Temperature: | -- °C | Relative Humidity: | --% |
| Test Voltage: | N/A | Phase : | L/N |
| Test Mode: | N/A | | |

Note: EUT is only power by battery, So it is not applicable for this test.

4. RADIATED EMISSION MEASUREMENT

4.1 RADIATED EMISSION LIMITS

In case the emission fall within the restricted band specified on Part 15.205(a), then the Part 15.209(a) and Part 15.231(b) limit in the table below has to be followed.

LIMITS OF RADIATED EMISSION MEASUREMENT (0.009MHz - 1000MHz)

| Frequencies (MHz) | Field Strength (micorvolts/meter) | Measurement Distance (meters) |
|-------------------|-----------------------------------|-------------------------------|
| 0.009~0.490 | 2400/F(KHz) | 300 |
| 0.490~1.705 | 24000/F(KHz) | 30 |
| 1.705~30.0 | 30 | 30 |
| 30~40.66 | 100 | 3 |
| 40.70~70 | 100 | 3 |

| Fundamental Frequency (MHz) | Field Strength of fundamental (microvolts/meter) | Field Strength of Unwanted Emissions (microvolts/meter) |
|-----------------------------|--|---|
| 40.66~40.70 | 2,250 | 225 |
| 70~130 | 1,250 | 125 |
| 130~174 | 1,250 to 3,750** | 125 to 375** |
| 174~260 | 3750 | 375 |
| 260~470 | 3,750 to 12,500** | 375 to 1,250** |
| Above 470 | 12,500 | 1,250 |

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

| FREQUENCY (MHz) | Class B (dBuV/m) (at 3M) | |
|-----------------|--------------------------|---------|
| | PEAK | AVERAGE |
| Above 1000 | 74 | 54 |

NOTE:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) Emission level (dBuV/m)=20log Emission level (uV/m).

LIMITS OF RESTRICTED FREQUENCY BANDS

| FREQUENCY (MHz) | FREQUENCY (MHz) | FREQUENCY (MHz) | FREQUENCY (GHz) |
|-------------------|---------------------|-----------------|-----------------|
| 0.090-0.110 | 16.42-16.423 | 399.9-410 | 4.5-5.15 |
| 0.495-0.505 | 16.69475-16.69525 | 608-614 | 5.35-5.46 |
| 2.1735-2.1905 | 16.80425-16.80475 | 960-1240 | 7.25-7.75 |
| 4.125-4.128 | 25.5-25.67 | 1300-1427 | 8.025-8.5 |
| 4.17725-4.17775 | 37.5-38.25 | 1435-1626.5 | 9.0-9.2 |
| 4.20725-4.20775 | 73-74.6 | 1645.5-1646.5 | 9.3-9.5 |
| 6.215-6.218 | 74.8-75.2 | 1660-1710 | 10.6-12.7 |
| 6.26775-6.26825 | 108-121.94 | 1718.8-1722.2 | 13.25-13.4 |
| 6.31175-6.31225 | 123-138 | 2200-2300 | 14.47-14.5 |
| 8.291-8.294 | 149.9-150.05 | 2310-2390 | 15.35-16.2 |
| 8.362-8.366 | 156.52475-156.52525 | 2483.5-2500 | 17.7-21.4 |
| 8.37625-8.38675 | 156.7-156.9 | 2690-2900 | 22.01-23.12 |
| 8.41425-8.41475 | 162.0125-167.17 | 3260-3267 | 23.6-24.0 |
| 12.29-12.293 | 167.72-173.2 | 3332-3339 | 31.2-31.8 |
| 12.51975-12.52025 | 240-285 | 3345.8-3358 | 36.43-36.5 |
| 12.57675-12.57725 | 322-335.4 | 3600-4400 | Above 38.6 |
| 13.36-13.41 | | | |

| Spectrum Parameter | Setting |
|---------------------------------------|-----------------------|
| Detector | Peak |
| Attenuation | Auto |
| Start Frequency | 1000 MHz |
| Stop Frequency | 10th carrier harmonic |
| RB / VB (emission in restricted band) | 1MHz / 3MHz |

| Receiver Parameter | Setting |
|------------------------|--------------------------------------|
| Attenuation | Auto |
| Start ~ Stop Frequency | 9kHz~90kHz / RB 200Hz for PK & AV |
| Start ~ Stop Frequency | 90kHz~110kHz / RB 200Hz for QP |
| Start ~ Stop Frequency | 110kHz~490kHz / RB 200Hz for PK & AV |
| Start ~ Stop Frequency | 490kHz~30MHz / RB 9kHz for QP |
| Start ~ Stop Frequency | 30MHz~1000MHz / RB 120kHz for QP |



4.2 TEST PROCEDURE

- a. The test is performed in a 3m Semi-Anechoic Chamber; the antenna factor, cable loss and so on of the site (factors) is calculated to correct the reading. The EUT is placed on a 0.8m high insulating Turn Table, and keeps 3m away from the Test Antenna, which is mounted on a variable-height antenna master tower. During test, The table was rotated 360 degrees to determine the position of the highest radiation.
- b. In the frequency range of 9KHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- c. In the frequency range 30MHz-1GHz, Bi-Log Test Antenna used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.
- d. In the frequency above 1GHz, Place the measurement antenna 3m away from the EUT for each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- f. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- g. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- h. For the actual test configuration, please refer to the related Item –EUT Test Photos.

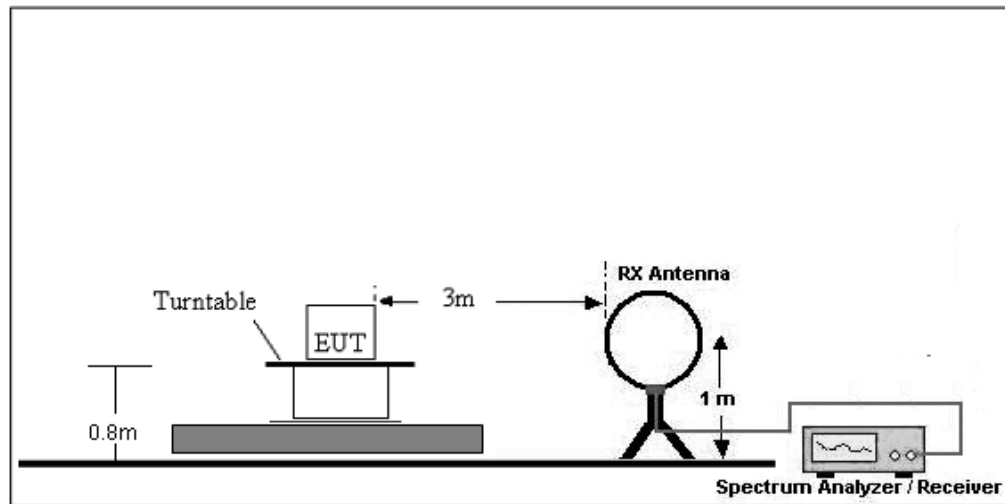
Both horizontal and vertical antenna polarities and performed pretest to three orthogonal axis were tested. The worst case emissions were reported

4.3 DEVIATION FROM TEST STANDARD

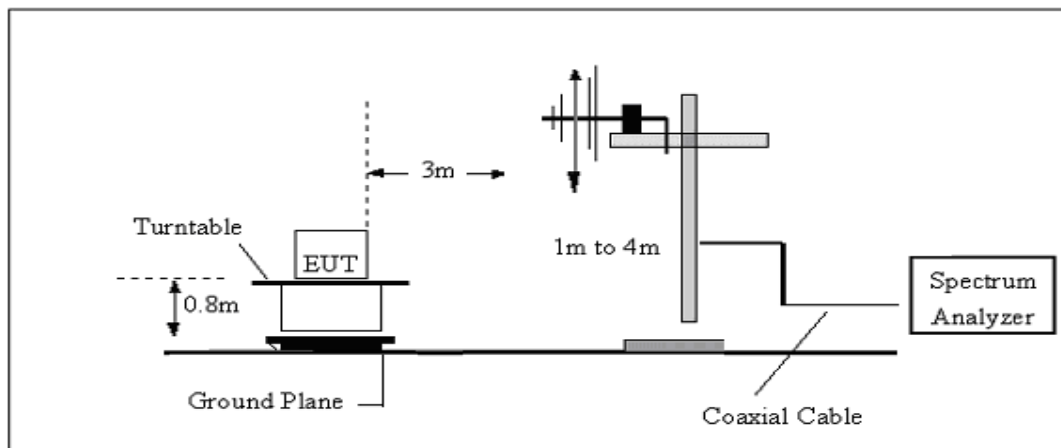
No deviation

4.4 TEST SETUP

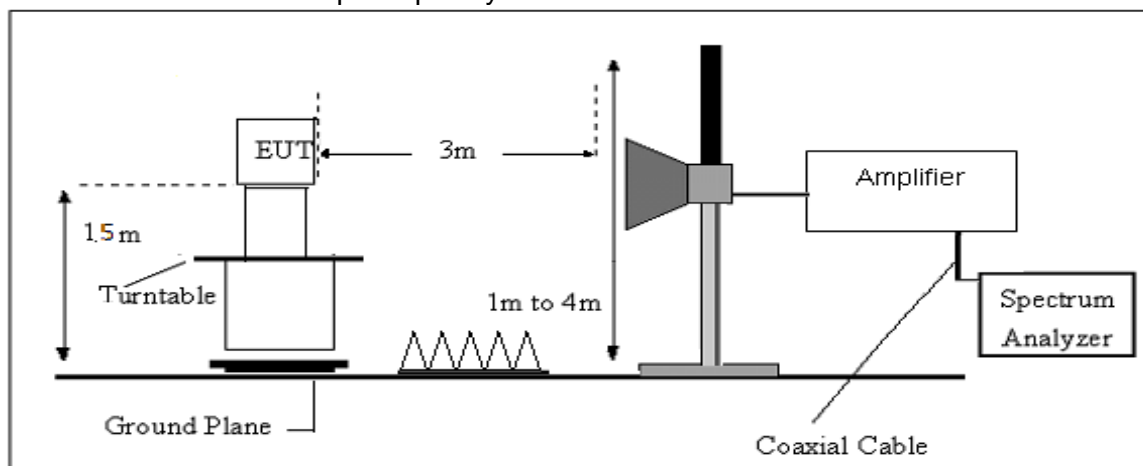
(A) Radiated Emission Test-Up Frequency Below 30MHz



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



4.5 EUT OPERATING CONDITIONS

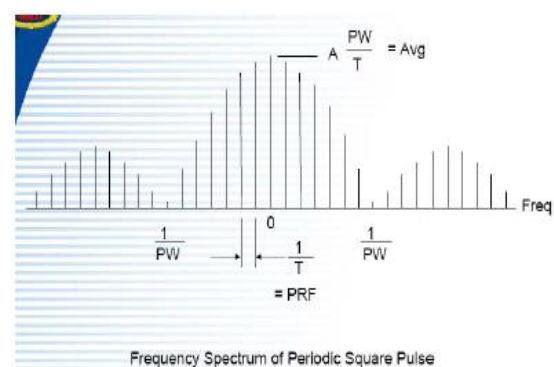
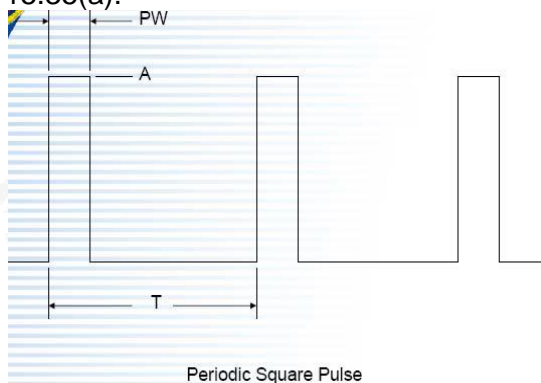
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

4.6 TEST RESULTS

INTRODUCTION TO PDCF

Reference: (§15.35 Measurement detector functions and bandwidths.)

- a. Part 15 of the FCC Rules provides for the operation of low power communication devices without an individual license (e.g., intrusion detectors, pulsed water tank level gauges, etc.), subject to certain requirements. Some of these devices use extremely narrow pulses to generate wideband emissions, which are measured to determine compliance with the rules. These measurements are typically performed with a receiver or spectrum analyzer. Depending on a number of factors (e.g., resolution bandwidth, pulsewidth, etc.), the spectrum analyzer may not always display the true peak value of the measured emission. This effect, called “pulse desensitization,” relates to the capabilities of the measuring instrument. For the measurement and reporting of the true peak of pulsed emissions, it may be necessary to apply a “pulse desensitization correction factor” (PDCF) to the measured value, pursuant to 47 CFR 15.35(a).



If using spectrum analyzer to measure pulse signal, it have to make sure the RBW use is at least $2/PW$.

•When RBW is less than $2/PW$, you are able to measure the true peak level of the pulse signal. If this is the case, PDCF is required to compensate to determine true peak value.

Pulse desensitization:

$PW = 53550 \mu\text{sec}$, Period = $100000 \mu\text{sec}$, Level = A

$RBW > 2/PW = 0.037 \text{ K}$, $1/T = 0.01 \text{ K}$

NOTE: $2 / PW < RBW$, first don't need

- b. For the actual test, please refer to the ANSI C63.10, Annex C refer to section 6. for more detail

4.7 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where

FS = Field Strength

CL = Cable Attenuation Factor (Cable Loss)

RA = Reading Amplitude

AG = Amplifier Gain

AF = Antenna Factor

For example

| Frequency | FS | RA | AF | CL | AG | Factor |
|-----------|----------|----------|------|------|------|--------|
| (MHz) | (dBμV/m) | (dBμV/m) | (dB) | (dB) | (dB) | (dB) |
| 300 | 40 | 58.1 | 12.2 | 1.6 | 31.9 | -18.1 |

$$\text{Factor} = AF + CL - AG$$

4.8 TEST RESULTS

(Radiated Emission < 30MHz (9KHz-30MHz, H-field))

| Freq. | Reading | Limit | Margin | State |
|-------|----------|----------|--------|-------|
| (MHz) | (dBuV/m) | (dBuV/m) | (dB) | P/F |
| -- | -- | -- | -- | PASS |
| -- | -- | -- | -- | PASS |

Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log (\text{specific distance/test distance})$ (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

Between 30MHz – 5000 MHz

433.92 MHz

| | | | |
|---------------|---------|--------------------|------------|
| Temperature: | 23.1 °C | Relative Humidity: | 60% |
| Test Voltage: | DC 3V | Phase: | Horizontal |
| Test Mode: | Mode 1 | | |

| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|--------------------|-------------------|-------------------------|--------------------|-------------------|----------------|--------|
| 1 | 224.0000 | 48.91 | -19.38 | 29.53 | 46.00 | -16.47 | peak |
| 2 | 385.0200 | 39.60 | -11.92 | 27.68 | 46.00 | -18.32 | peak |
| 4 | 825.4000 | 36.53 | -1.31 | 35.22 | 46.00 | -10.78 | peak |
| 5 | 868.0800 | 33.01 | -0.51 | 32.50 | 46.00 | -13.50 | peak |
| 6 | 949.5600 | 28.82 | 1.58 | 30.40 | 46.00 | -15.60 | peak |

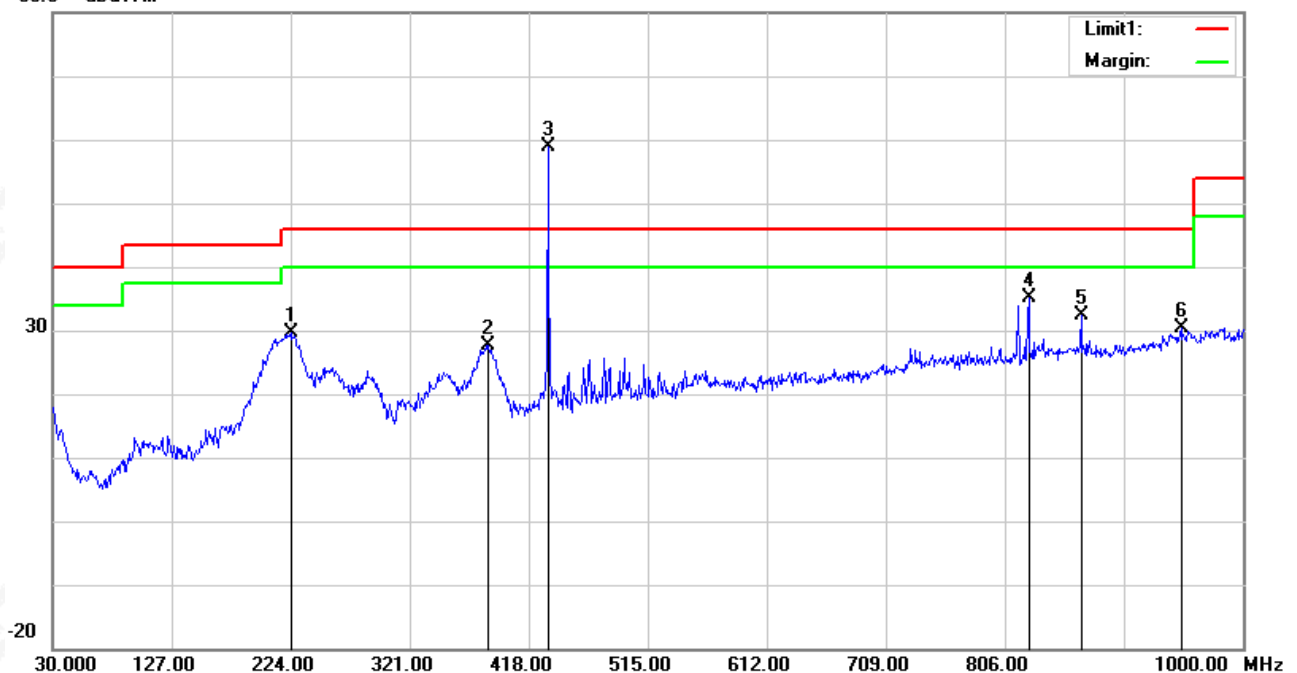
Fundamental Frequency

| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Duty cycle Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|--------------------|-------------------|-------------------------|----------------------------|--------------------|-------------------|----------------|--------|
| 3 | 433.9200 | 69.08 | -10.13 | - | 58.95 | 100.83 | -41.88 | Peak |
| 3 | 433.9200 | 69.08 | -10.13 | 11.84 | 47.11 | 80.83 | -33.72 | AV |

Remark:

1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result = Reading + Factor) – Limit
3. Factor = LISN factor + Cable loss + Limiter (10dB)

80.0 dBuV/m



| | | | |
|---------------|---------|--------------------|----------|
| Temperature: | 23.1 °C | Relative Humidity: | 60% |
| Test Voltage: | DC 3V | Phase: | Vertical |
| Test Mode: | Mode 1 | | |

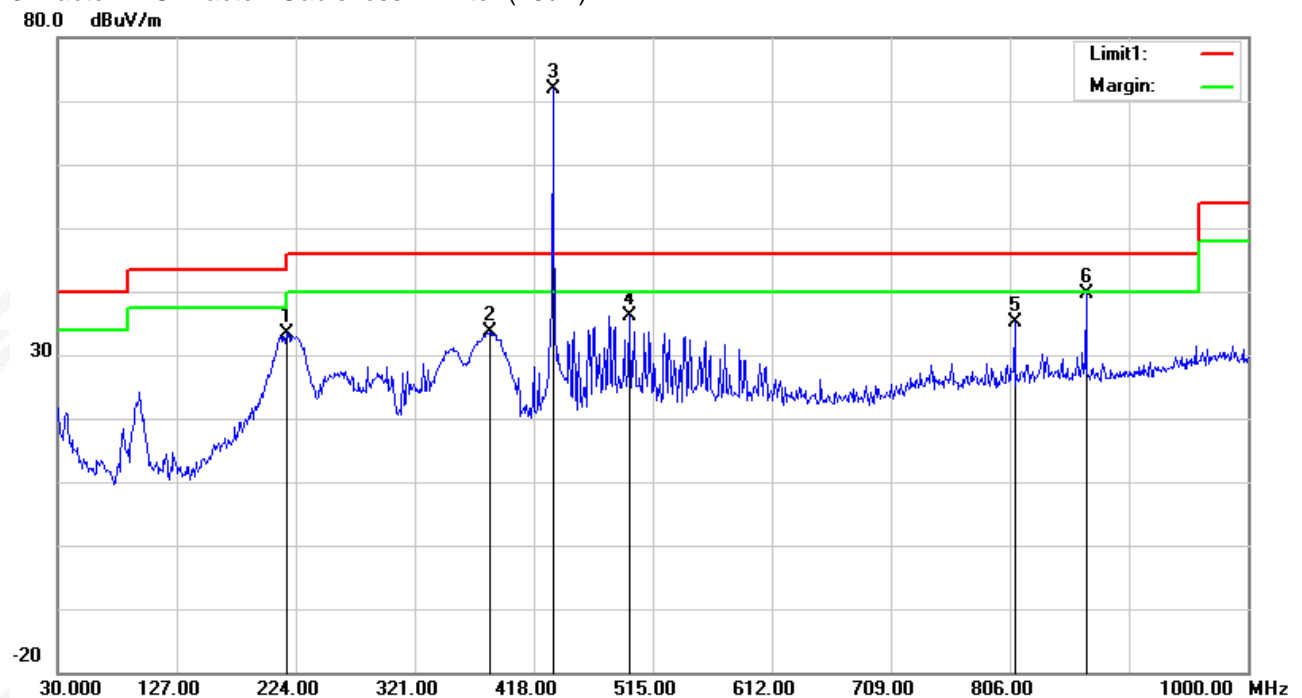
| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|--------------------|-------------------|-------------------------|--------------------|-------------------|----------------|--------|
| 1 | 216.2400 | 53.36 | -20.05 | 33.31 | 46.00 | -12.69 | peak |
| 2 | 382.1100 | 45.68 | -12.13 | 33.55 | 46.00 | -12.45 | peak |
| 4 | 495.6000 | 44.15 | -8.10 | 36.05 | 46.00 | -9.95 | peak |
| 5 | 809.8800 | 37.16 | -2.00 | 35.16 | 46.00 | -10.84 | peak |
| 6 | 868.0800 | 40.12 | -0.51 | 39.61 | 46.00 | -6.39 | peak |

Fundamental Frequency

| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Duty cycle Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|--------------------|-------------------|-------------------------|----------------------------|--------------------|-------------------|----------------|--------|
| 3 | 433.9200 | 82.04 | -10.13 | - | 71.91 | 100.83 | -28.92 | Peak |
| 3 | 433.9200 | 82.04 | -10.13 | 11.84 | 60.07 | 80.83 | -20.76 | AV |

Remark:

1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result =Reading + Factor)–Limit
3. Factor=LISN factor+Cable loss+Limiter (10dB)



315 MHz

| | | | |
|---------------|---------|--------------------|------------|
| Temperature: | 23.1 °C | Relative Humidity: | 60% |
| Test Voltage: | DC 3V | Phase: | Horizontal |
| Test Mode: | Mode 1 | | |

| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|--------------------|-------------------|-------------------------|--------------------|-------------------|----------------|--------|
| 1 | 219.1500 | 51.99 | -19.70 | 32.29 | 46.00 | -13.71 | peak |
| 3 | 375.3200 | 40.96 | -12.37 | 28.59 | 46.00 | -17.41 | peak |
| 4 | 499.4800 | 35.91 | -8.02 | 27.89 | 46.00 | -18.11 | peak |
| 5 | 823.4600 | 34.63 | -1.54 | 33.09 | 46.00 | -12.91 | peak |
| 6 | 902.0300 | 45.27 | -0.40 | 44.87 | 46.00 | -1.13 | peak |

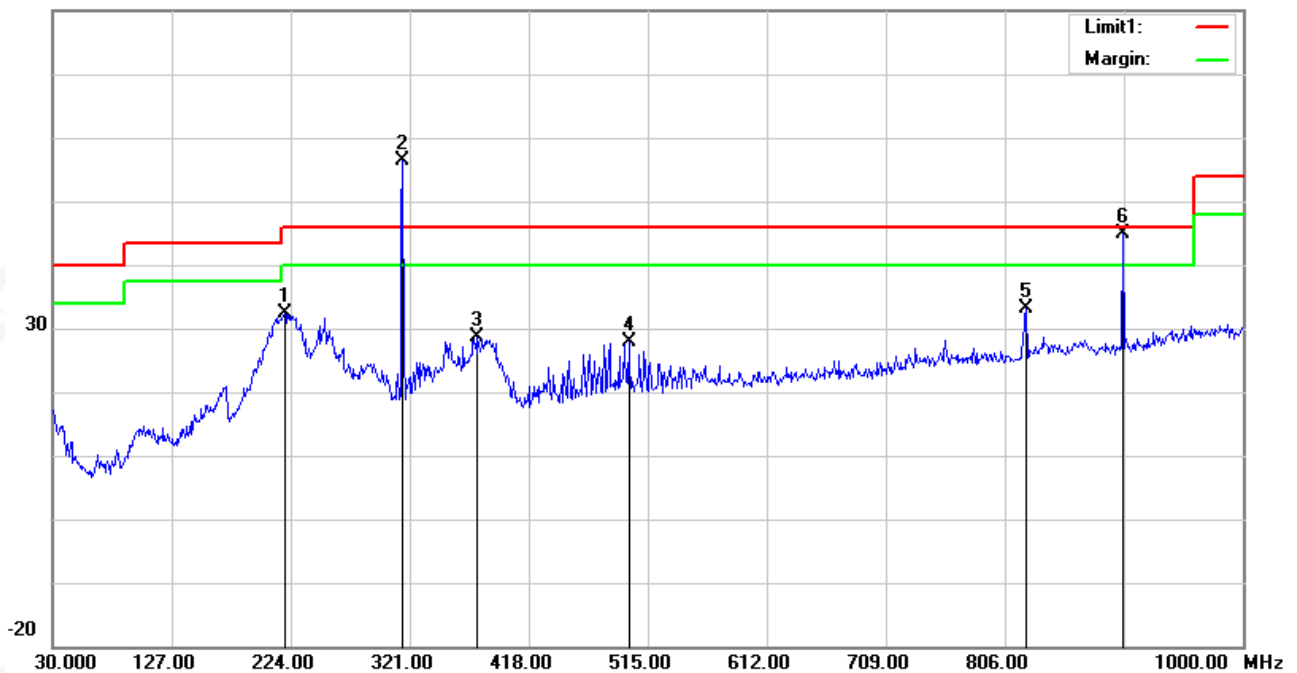
Fundamental Frequency

| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Duty cycle Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|--------------------|-------------------|-------------------------|----------------------------|--------------------|-------------------|----------------|--------|
| 2 | 315.0000 | 70.66 | -14.22 | - | 56.44 | 95.63 | -39.19 | Peak |
| 2 | 315.0000 | 70.66 | -14.22 | 13.42 | 43.02 | 75.63 | -32.61 | AV |

Remark:

1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result =Reading + Factor)-Limit
3. Factor=LISN factor+Cable loss+Limiter (10dB)

80.0 dBuV/m



| | | | |
|---------------|---------|--------------------|----------|
| Temperature: | 23.1 °C | Relative Humidity: | 60% |
| Test Voltage: | DC 3V | Phase: | Vertical |
| Test Mode: | Mode 1 | | |

| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|--------------------|-------------------|-------------------------|--------------------|-------------------|----------------|--------|
| 1 | 224.9700 | 50.90 | -19.32 | 31.58 | 46.00 | -14.42 | peak |
| 3 | 378.2300 | 45.43 | -12.31 | 33.12 | 46.00 | -12.88 | peak |
| 4 | 479.1100 | 43.35 | -8.68 | 34.67 | 46.00 | -11.33 | peak |
| 5 | 820.5500 | 34.47 | -1.90 | 32.57 | 46.00 | -13.43 | peak |
| 6 | 945.6800 | 30.47 | 1.50 | 31.97 | 46.00 | -14.03 | peak |

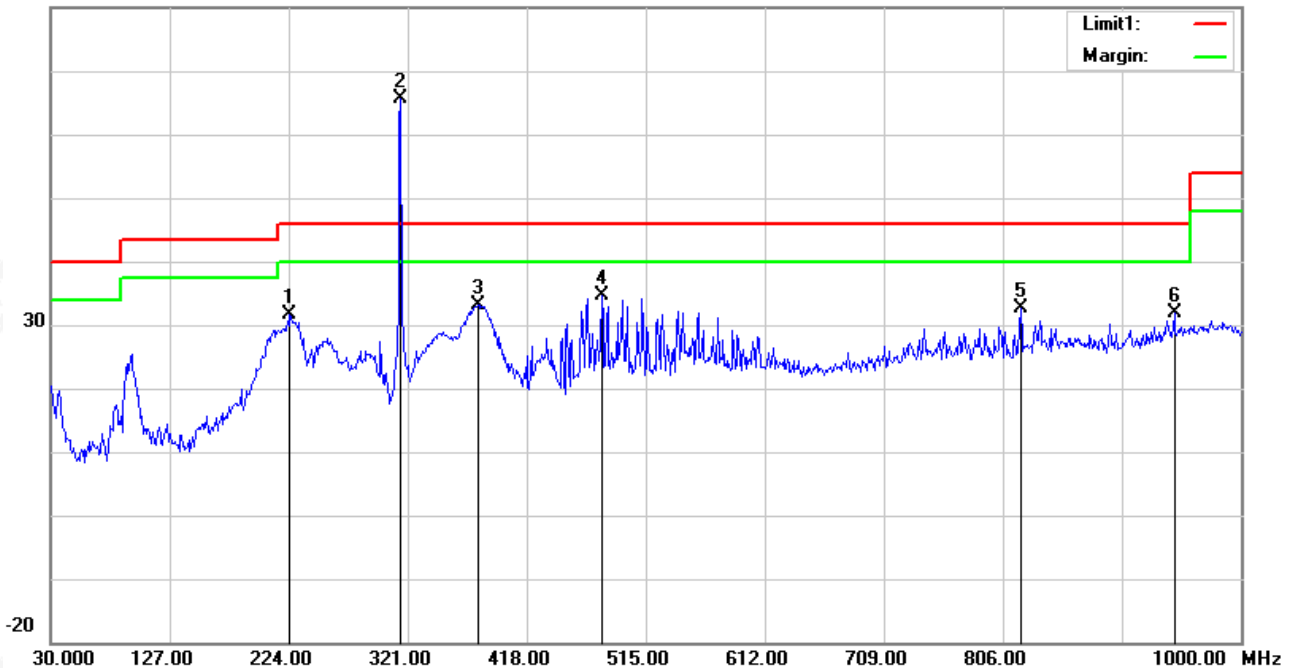
Fundamental Frequency

| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Duty cycle Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|--------------------|-------------------|-------------------------|----------------------------|--------------------|-------------------|----------------|--------|
| 2 | 315.0000 | 79.86 | -14.22 | - | 65.64 | 95.63 | -29.99 | Peak |
| 2 | 315.0000 | 79.86 | -14.22 | 13.42 | 52.22 | 75.63 | -23.41 | AV |

Remark:

1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result = Reading + Factor) – Limit
3. Factor = LISN factor + Cable loss + Limiter (10dB)

80.0 dBuV/m



PEAK TEST RESULTS:

433.92MHz

| Frequency | Meter Reading | Detector | Amplifier | Loss | Antenna Factor | Orrected Factor | Corrected Amplitude | FCC Part 15.231/15.209/205 | | RX Antenna |
|-----------|---------------|------------|-----------|------|----------------|-----------------|---------------------|----------------------------|--------|------------|
| | | | | | | | | Limit | Margin | Polar |
| (MHz) | (dBμV/m) | (PK/QP/AV) | (dB) | (dB) | (dB/m) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | (H/V) |
| 1301.81 | 64.20 | PK | 45.1 | 4.0 | 25.1 | -16.00 | 48.20 | 74 | -25.80 | H |
| 1301.81 | 64.55 | PK | 45.1 | 4.0 | 25.1 | -16.00 | 48.55 | 74 | -25.45 | V |
| 1735.61 | 61.50 | PK | 44.1 | 5.3 | 25 | -13.80 | 47.70 | 74 | -26.30 | H |
| 1735.61 | 63.45 | PK | 44.1 | 5.3 | 25 | -13.80 | 49.65 | 74 | -24.35 | V |
| 2169.69 | 60.48 | PK | 43.8 | 5.4 | 25.9 | -12.47 | 48.01 | 74 | -25.99 | H |
| 2169.69 | 60.50 | PK | 43.8 | 5.4 | 25.9 | -12.47 | 48.03 | 74 | -25.97 | V |
| 2603.61 | 55.63 | PK | 44.4 | 6.0 | 27.6 | -10.77 | 44.86 | 74 | -29.14 | H |
| 2603.61 | 56.45 | PK | 44.4 | 6.0 | 27.6 | -10.77 | 45.68 | 74 | -28.32 | V |

315MHz

| Frequency | Meter Reading | Detector | Amplifier | Loss | Antenna Factor | Orrected Factor | Corrected Amplitude | FCC Part 15.231/15.209/205 | | RX Antenna |
|-----------|---------------|------------|-----------|------|----------------|-----------------|---------------------|----------------------------|--------|------------|
| | | | | | | | | Limit | Margin | Polar |
| (MHz) | (dBμV/m) | (PK/QP/AV) | (dB) | (dB) | (dB/m) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | (H/V) |
| 944.98 | 64.12 | PK | 45.1 | 4.0 | 25.1 | -16.00 | 48.12 | 74 | -25.88 | H |
| 944.98 | 64.29 | PK | 45.1 | 4.0 | 25.1 | -16.00 | 48.29 | 74 | -25.71 | V |
| 1260.19 | 61.67 | PK | 44.1 | 5.3 | 25 | -13.80 | 47.87 | 74 | -26.13 | H |
| 1260.19 | 63.43 | PK | 44.1 | 5.3 | 25 | -13.80 | 49.63 | 74 | -24.37 | V |
| 1575.05 | 60.41 | PK | 43.8 | 5.4 | 25.9 | -12.47 | 47.94 | 74 | -26.06 | H |
| 1575.05 | 60.93 | PK | 43.8 | 5.4 | 25.9 | -12.47 | 48.46 | 74 | -25.54 | V |
| 1890.04 | 55.64 | PK | 44.4 | 6.0 | 27.6 | -10.77 | 44.87 | 74 | -29.13 | H |
| 1890.04 | 56.03 | PK | 44.4 | 6.0 | 27.6 | -10.77 | 45.26 | 74 | -28.74 | V |

Note: Above 2.6 GHz The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

5. BANDWIDTH TEST

5.1 LIMIT

| FCC Part15.231,Subpart C | | | | |
|--------------------------|--------------|---|-----------------------|--------|
| Section | Test Item | Limit | Frequency Range (MHz) | Result |
| 15.231(C) | 20 Bandwidth | The20dB bandwidth of the emissions shall not exceed 0.25% of the center frequency | 433.92 and 315 | PASS |

| Spectrum Parameter | Setting |
|--------------------|-------------------------|
| Attenuation | Auto |
| Span Frequency | > Measurement Bandwidth |
| RB | 10 kHz (20dB Bandwidth) |
| VB | 30 kHz (20dB Bandwidth) |
| Detector | Peak |
| Trace | Max Hold |
| Sweep Time | Auto |

5.2 TEST REQUIREMENTS

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

5.3 TEST PROCEDURE

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- Spectrum Setting: RBW= 3KHz, VBW=10KHz, Sweep time = Auto.

5.4 TEST SETUP



5.5 EUT OPERATION CONDITIONS

TX mode.

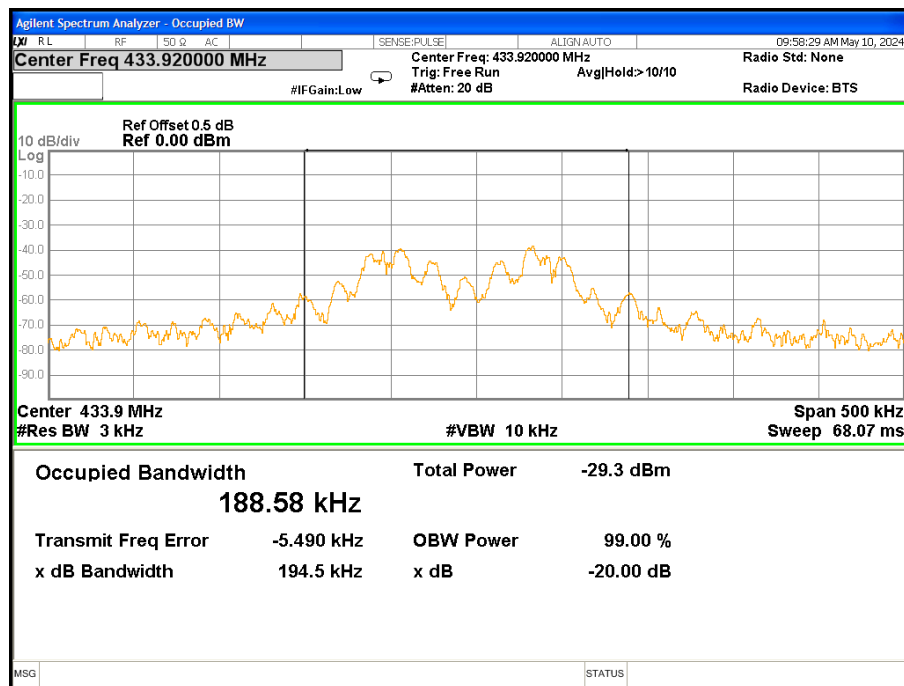


5.6 TEST RESULTS

433.92 MHz

| Centre Frequency | Measurement | | |
|------------------|----------------------|------------|--------|
| | 20dB Bandwidth (KHz) | Limit(kHz) | Result |
| 433.92 | 194.5 | 1084.8 | PASS |

433.92MHz

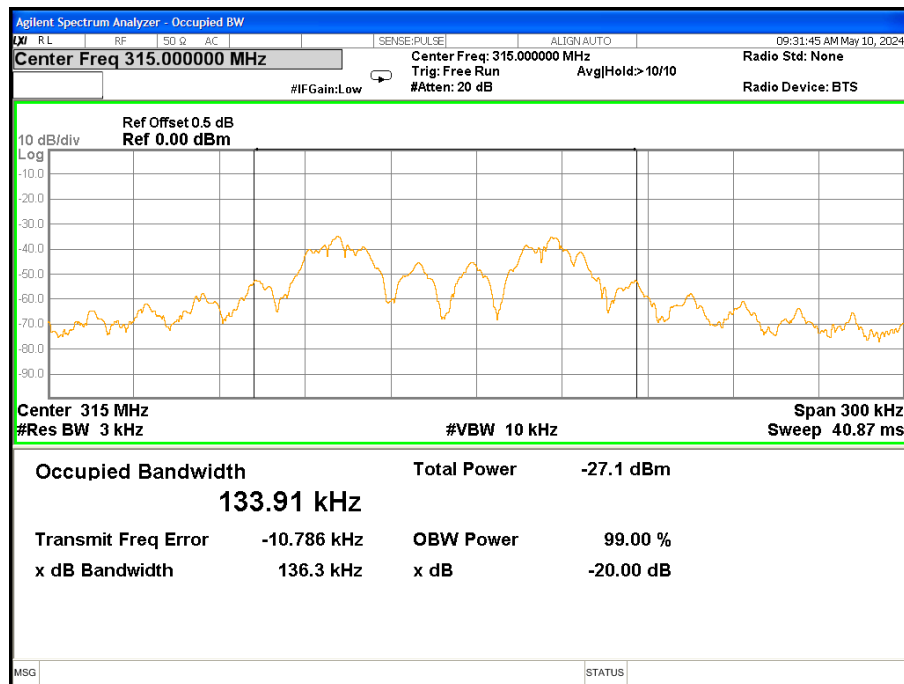




315 MHz

| Centre Frequency | Measurement | | |
|------------------|----------------------|------------|--------|
| | 20dB Bandwidth (KHz) | Limit(kHz) | Result |
| 315 | 136.3 | 787.5 | PASS |

315MHz



6. DUTY CYCLE

6.1 TEST PROCEDURE

The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.

The Duty Cycle Was Determined By The Following Equation: To Calculate The Actual Field Intensity, The Duty Cycle Correction Factor In Decibel Is Needed For Later Use And Can Be Obtained From Following Conversion

$$\text{Duty Cycle(\%)} = \frac{\text{Total On Interval In A Complete Pulse Train}}{\text{Length Of A Complete Pulse Train}} \times 100\%$$

$$\text{Duty Cycle Correction Factor(Db)} = 20 \times \log_{10}(\text{Duty Cycle(\%)})$$

6.2 TEST SETUP



6.3 EUT OPERATION CONDITIONS

TX mode.

6.4 TEST RESULTS

433.92MHz

| FCC Part15.231(a) | |
|---|--------|
| Total On interval in a complete pulse train(ms) | 25.6 |
| Length of a complete pulse train(ms) | 100 |
| Duty Cycle (%) | 25.60% |
| Duty Cycle Correction Factor(dB) | 11.84 |

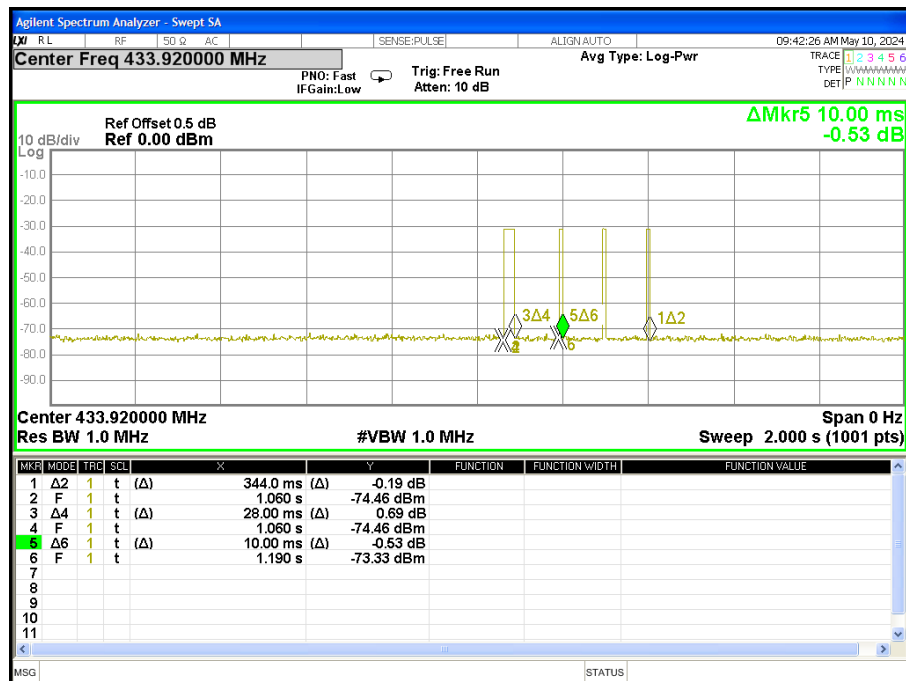
Refer to the duty cycle plot (as below), This device meets the FCC requirement. Length of a complete pulse train

Remark:FCC part15.35(c) required that a complete pulse train is more than 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.

Note: Number of pulse train 1 = 1, Time of single pulse train 1 = 25.6ms;

Total on interval in a complete pulse train= Number of pulse train 1x Time of single pulse train
1=1*25.6=25.6ms

TX Mode



315MHz

| FCC Part15.231(a) | |
|---|--------|
| Total On interval in a complete pulse train(ms) | 21.34 |
| Length of a complete pulse train(ms) | 100 |
| Duty Cycle (%) | 21.34% |
| Duty Cycle Correction Factor(dB) | 13.42 |

Refer to the duty cycle plot (as below), This device meets the FCC requirement. Length of a complete pulse train

Remark:FCC part15.35(c) required that a complete pulse train is more than 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.

Note: Number of pulse train 1 = 2, Time of single pulse train 1 = 10.67ms;

Total on interval in a complete pulse train= Number of pulse train 1x Time of single pulse train
 $1=2 \times 10.67=21.34\text{ms}$

TX Mode



7. AUTOMATICALLY DEACTIVATE

7.1 STANDARD REQUIREMENT

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

7.2 TEST PROCEDURE

The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.

Spectrum Setting : RBW= 1000KHz, VBW=1000KHz, Sweep time = Auto.

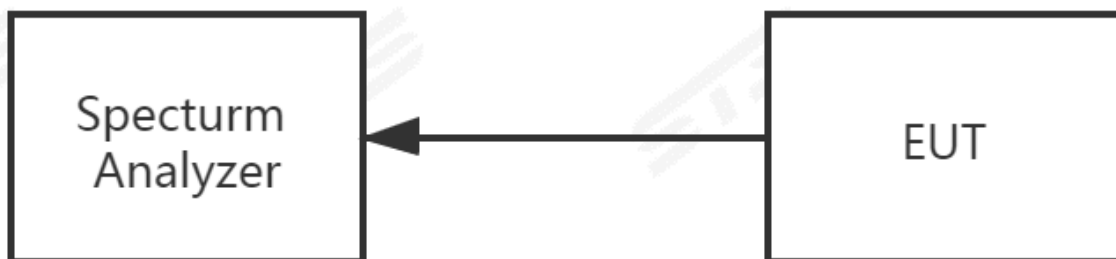
Note: Only press launch about 0.15 s

Note:

(1)Refer to the plot (As Below),We find a manually operated transmitter shall employ a switch that will automatically deactivate the transmitter immediately, within not more than 5 seconds of being released.

(2)The EUT is comply with FCC PART 15 clause 15.231(a)(1) manually working mode are pre-tested and only the worst result is reported.

7.3 TEST SETUP

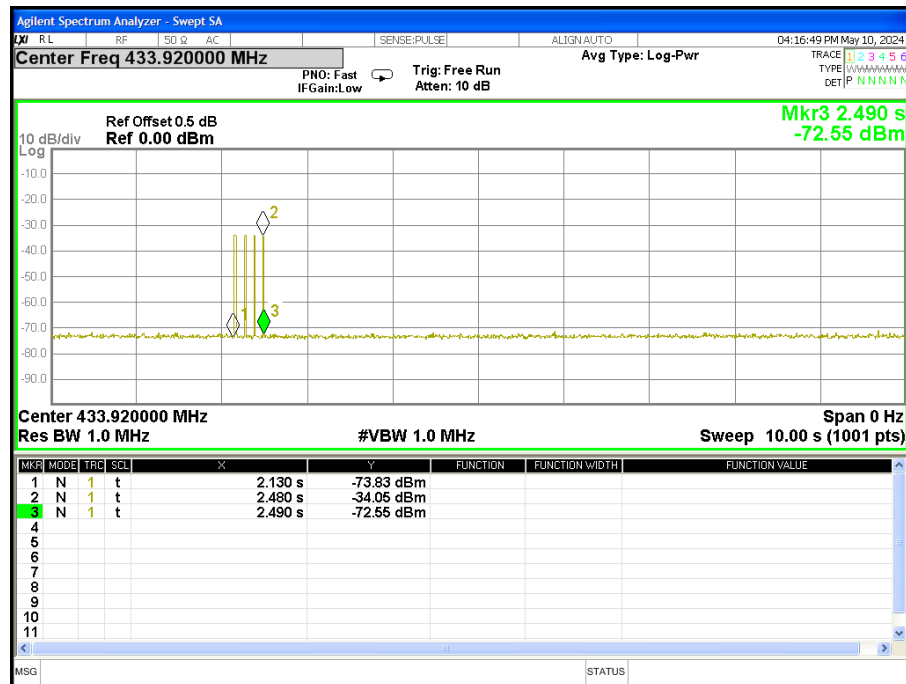




7.4 TEST RESULTS

433.92MHz

| Activation time | Limit(Sec) | Result |
|-----------------|------------|--------|
| 0.36 s | 5 s | Pass |



Mark 1: Hold down the Key(Start transmitting)

Mark 2: Loose the Key

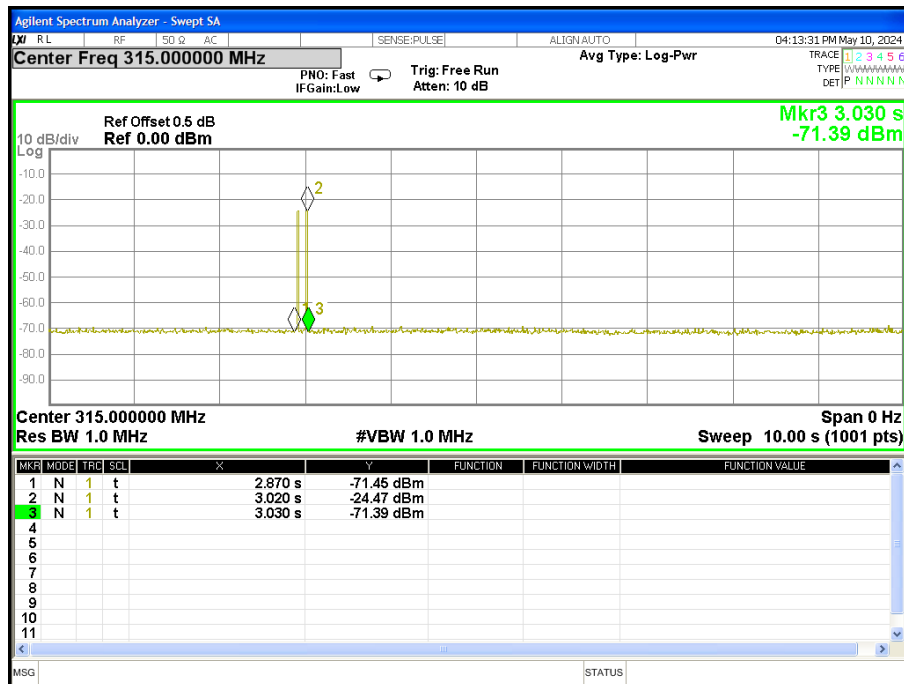
Mark 3: Stop transmitting

Activation time= Mark 2- Mark 1=2.490-2.130=0.36s



315MHz

| Activation time | Limit(Sec) | Result |
|-----------------|------------|--------|
| 0.16 s | 5 s | Pass |



Mark 1: Hold down the Key(Start transmitting)

Mark 2: Loose the Key

Mark 3: Stop transmitting

Activation time= Mark 2- Mark 1=3.030-2.870=0.16 s



8. ANTENNA REQUIREMENT

8.1 STANDARD REQUIREMENT

According to the FCC Part 15 Paragraph 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

8.2 EUT ANTENNA

The EUT antenna is Internal Antenna. It conforms to the standard requirements.



APPENDIX 1-PHOTOS OF TEST SETUP

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

*****END OF THE REPORT*****